REMARKS/ARGUMENTS

In accordance with the Examiner's requirement, applicant hereby affirms the election of filter media apparatus claims 1-49. This election is made without prejudice to applicant's right to file a divisional application on method claims 50-78.

Claims 1-78 have been canceled. Filter media apparatus claims 1-49 have been replaced by filter media apparatus claims 79-102, to better define the invention.

Consideration and allowance of claims 79-102 is earnestly solicited.

Claim 79 defines in combination high performance filter media having nanofibers of diameter less than 1 μm incorporated and processed into internal structure of a filter medium dominantly composed of coarse fibers of diameter greater than 1μm, and requires that the filter media have distally opposite upstream and downstream faces normal to flow therethrough and defining a single layer filter media thickness therebetween, and requires that such internal structure incorporate between the noted faces and within the single layer at least one of the defined macrostructures in combination with at least one of the defined microstructures, namely macrostructure A wherein the nanofibers are distributed uniformly throughout the filter media and within the single layer, macrostructure B wherein the nanofibers are distributed unevenly in bundles providing pockets of nanofibers in a matrix of coarse fibers all within the single layer, macrostructure C wherein the nanofibers are concentrated at one of the faces and within the single layer, microstructure 1 wherein the nanofibers at the nanofiber/coarse fiber interface form bridges across pores between coarse fibers all within the single layer, microstructure 2 wherein the nanofibers at the nanofiber/coarse fiber interface substantially cling onto the coarse fibers all within the single layer, microstructure 3 wherein at the nanofiber/coarse fiber interface there is no significant bridging of the nanofibers across the pores between the coarse fibers and no significant clinging of the nanofibers onto the coarse fibers and instead the nanofibers clump together all within the single layer. The defined macrostructure/microstructure combination is not believed reasonably taught in the references.

Kahlbaugh et al. U.S. Patent 6,521,321 deals with multi-layer structures, and does not teach the construction in a single layer defined in claim 79. In referring to Fig. 5, Col. 12, lines 20+, Kahlbaugh et al. '321 notes, Col. 12, lines 28-31:

> *That is, the media comprises a web of fine fibers on at least one outer surface of a structure of coarse fibers. The fine fibers in the web of fine fibers, then, are not mixed in or entangled with the coarse fiber matrix.*

This is also recognized by the Examiner in the Office Action, page 9, clause 41, noting that Kahlbaugh et al. '321 provides fine and coarse fibers that are not mixed together or entangled, but rather substrates positioned upon other substrates.

Fischer U.S. Patent 5,800,706 shows in Fig. 1 a nanofiber mat at 50,000 magnification, and in Figs. 2, 3, 4, at respective magnifications of 2,000, 200, 100, combination structures including scaffold particulates. It is noted at Col. 1, lines 10+, that nanofibers may be uniformly or non-uniformly blended with supporting scaffold particulates, and, Col. 7, lines 26+, that, preferably, the scaffold particulate has a shape of a fiber, and, Col. 7, lines 60+, blending nanofibers with other, larger diameter fibers or particulate materials to serve as a scaffolding to hold the smaller nanofibers apart and prevent them from collapsing. Applicant has reviewed Fischer '706 but has been unable to identify disclosure or teaching of the macrostructure and microstructure combination defined in claim 79 including in a single layer between the upstream and downstream faces of the media the defined combination of at least one of macrostructures A, B, C and the defined nanofiber/coarse fiber interface microstructures 1, 2, 3. It is respectfully submitted that the combination is novel and non-obvious. Till et al. U.S. Patent 3,073,735 and Wilson et al. U.S. Patent 6,155,432 have been reviewed, and are not found to teach or suggest the defined macrostructure/microstructure combination.

Consideration and allowance of claim 79 is earnestly solicited.

Claim 80 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 80 requires that the defined internal structure incorporate

the nanofibers with the coarse fibers in an intermingled configuration in the defined single layer without a nanofiber mat. In contrast, in Fischer '706, it appears that, even with the noted blending of larger diameter scaffold fibers with nanofibers, a nanofiber mat is still retained, Col. 9, line 62. In contrast, the combination now defined in claim 80 requires that the internal structure, including the defined macrostructure/microstructure combination, incorporate the nanofibers with the coarse fibers in an intermingled configuration in a single layer without a nanofiber mat. Consideration and allowance of claim 80 is respectfully requested.

Claim 81 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 81 requires that the nanofibers have portions extending normal to the defined upstream and downstream faces, such that the normally extending nanofiber portions increase attachment strength to the coarse fibers, reduce delamination risk of the nanofibers, and reduce pressure drop due to increased orientation of the nanofibers in the direction of flow. Applicant has carefully reviewed the references, but is unable to find a teaching of these features. In the Office Action, bottom of page 7, it is noted that the Examiner takes the position, referring to Fischer '706 that one set of nanofibers extend normal to one face of the filter. In response, and in view of the advantages and improved performance, including as recited in claim 81, applicant respectfully notes MPEP 2144.03 indicating "the rationale supporting an obviousness rejection may be based on common knowledge in the art or 'well-known' prior art" and "the Examiner may take official notice of facts outside of the record which are capable of instant and unquestionable demonstration as being 'well-known' in the art" and "if justified, the Examiner should not be obliged to spend time to produce documentary proof" and "if the knowledge is of such notorious character that official notice can be taken, it is sufficient so to state". However, MPEP 2144.03 also notes, second paragraph, last sentence "if the applicant traverses such an assertion the Examiner should cite a reference in support of his or her position". Applicant hereby respectively but vigorously traverses such assertion by the Examiner. In view of the advantages and enhanced performance afforded by the

invention set forth in claim 81, as noted above, it is respectfully submitted that the combination defined in claim 81 is not obvious. Individual pieces of the puzzle were known, but not the defined combination. For simplification of the issues, applicant hereby admits that the isolated aspect of providing a fiber normal to a filter media face is in and of itself known in the prior art. However, there is no teaching in the prior art of the combination defined in claim 81. It is respectfully submitted that it begs the question to state merely that individual components were known. If such a combination is novel, the issue is whether bringing them together as taught by the inventor was obvious in light of the prior art. It is respectfully submitted that the cognition, selection and application in the combination defined in claim 81 is novel, non-obvious, and not recognized in the prior art. The defined combination requires linking association involving a cognitive step not suggested previously in the art. It is further respectfully submitted that it may be that in certain circumstances the very choice of the elements to be selected and their limitations in combination is not obvious. Consideration and allowance of claim 81 is earnestly solicited.

Claim 82 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 82 particularly requires macrostructure A (e.g. as supported by Fig. 1) in combination with microstructure 1 (e.g. as supported by Fig. 4). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure A wherein the nanofibers are distributed uniformly throughout the filter media and within the single layer in combination with microstructure 1 wherein the filter media has a nanofiber/coarse fiber interface wherein the nanofibers form bridges across pores between the coarse fibers all within the single layer.

Claim 83 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 82 particularly requires macrostructure A (e.g. as supported by Fig. 1) in combination with microstructure 2 (e.g. as supported by Fig. 5). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure A wherein the nanofibers are

distributed uniformly throughout the filter media and within the single layer in combination with microstructure 2 wherein the filter media has a nanofiber/coarse fiber interface wherein the nanofibers substantially cling onto the coarse fibers all within the single layer.

Claim 84 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 84 particularly requires macrostructure A (e.g. as supported by Fig. 1) in combination with microstructure 3 (e.g. as supported by Fig. 6). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure A wherein the nanofibers are distributed uniformly throughout the filter media and within the single layer in combination with microstructure 3 wherein the filter media has a nanofiber/coarse fiber interface wherein there is no significant bridging of nanofibers across the pores between the coarse fibers and no significant clinging of the nanofibers onto said coarse fibers and instead the nanofibers clump together all within the single layer.

Claim 85 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 85 particularly requires macrostructure B (e.g. as supported by Fig. 2) in combination with microstructure 1 (e.g. as supported by Fig. 4). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure B wherein the nanofibers are distributed unevenly in bundles providing pockets of nanofibers in a matrix of coarse fibers all within the single layer in combination with microstructure 1 wherein the filter media has a nanofiber/coarse fiber interface wherein the nanofibers form bridges across pores between the coarse fibers all within the single layer.

Claim 86 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 86 particularly requires macrostructure B (e.g. as supported by Fig. 2) in combination with microstructure 2 (e.g. as supported by Fig. 5). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure B wherein the nanofibers are distributed unevenly in bundles providing pockets of nanofibers in a matrix of coarse fibers

all within the single layer in combination with microstructure 2 wherein the filter media has a nanofiber/coarse fiber interface wherein the nanofibers substantially cling onto the coarse fibers all within the single layer.

Claim 87 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 87 particularly requires macrostructure B (e.g. as supported by Fig. 2) in combination with microstructure 3 (e.g. as supported by Fig. 6). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure B wherein the nanofibers are distributed unevenly in bundles providing pockets of nanofibers in a matrix of coarse fibers all within the single layer in combination with microstructure 3 wherein the filter media has a nanofiber/coarse fiber interface wherein there is no significant bridging of nanofibers across the pores between the coarse fibers and no significant clinging of the nanofibers onto the coarse fibers and instead the nanofibers clump together all within the single layer.

Claim 88 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 88 particularly requires macrostructure C (e.g. as supported by Fig. 3) in combination with microstructure 1 (e.g. as supported by Fig. 4). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure C wherein the nanofibers are concentrated at one of the faces and within the single layer in combination with microstructure 1 wherein the filter media has a nanofiber/coarse fiber interface wherein the nanofibers form bridges across pores between the coarse fibers all within the single layer.

Claim 89 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 89 particularly requires macrostructure C (e.g. as supported by Fig. 3) in combination with microstructure 2 (e.g. as supported by Fig. 5). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure C wherein the nanofibers are concentrated at one of the faces and within the single layer in combination with

microstructure 2 wherein the filter media has a nanofiber/coarse fiber interface wherein the nanofibers substantially cling onto the coarse fibers all within the single layer.

Claim 90 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 90 particularly requires macrostructure C (e.g. as supported by Fig. 3) in combination with microstructure 3 (e.g. as supported by Fig. 6). It is respectfully submitted that the particularly defined combination is allowable. The references do not teach the construction of macrostructure C wherein the nanofibers are concentrated at one of the faces and within the single layer in combination with microstructure 3 wherein the filter media has a nanofiber/coarse fiber interface wherein there is no significant bridging of nanofibers across the pores between the coarse fibers and no significant clinging of the nanofibers onto the coarse fibers and instead the nanofibers clump together all within the single layer.

Claim 91 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 91 defines a combination wherein the nanofibers are distributed unevenly in the filter media such that the nanofibers are concentrated in bundles providing pockets of nanofibers in a matrix of coarse fibers, and that the pockets provide spatially distinct areas of greater filtration efficiency in a matrix of lesser filtration efficiency, and that the nanofibers are provided in low enough concentration and small enough diameter that there is insubstantial difference in flow velocity, relative to media without nanofibers, through the media across the faces thereof until the nanofiber bundles begin to plug, whereupon flow is increasingly diverted through coarse fiber sections in the matrix between the pockets such that filtration efficiency is increased relative to media without nanofibers at the same flow velocity and pressure drop, at least initially until the nanofiber bundles begin to plug, and that the filter media be composed of macrostructure B and that each of the bundles comprise one or more nanofibers twisted and intermingled into an assemblage, and that the longest dimension of the bundle is less than the filter media thickness. In the Office Action, page 7, clause 29, the Examiner notes that in Fischer '706 the distribution of scaffolding fibers and nanofibers is not uniform, Col. 9, lines 30-33, and

that the nanofibers may congregate and form bundles or web-like domains, Col. 9, lines 35-36. In the Office Action, page 7, clause 30, it is noted that the Examiner takes the position that as the composition of the filter media may contain 1-99 weight percent scaffold fiber and 1-99 weight percent nanofiber and as the nanofibers meet the diameter limitation set forth in a parent claim, the nanofibers "are provided in low enough concentration and small enough diameter that there is insubstantial difference in flow velocity, relative to media without nanofibers, through said media across a face thereof until said nanofiber bundles begin to plug...". In the Office Action, page 8, clause 33, the Examiner notes that the dimension of the bundles in Fischer '706 have not been measured, however as the prior art meets the chemical and physical limitations set forth in parent claims, the applied claims are rejected. In response, it is respectfully submitted that the combination now defined in claim 91 is nowhere taught nor reasonably suggested in the references. To the extent, and if, claim 91 is to be rejected on similar grounds as noted above, then applicant respectfully but vigorously again invokes MPEP 2144.03, second paragraph, last sentence, and traverses such assertion without supporting authority of record.

Claim 92 depends from claim 91 and is believed allowable for the reasons noted above. Furthermore, claim 92 requires that the longest dimension of the bundle be in the range of 10% to 50% of the single layer filter media thickness. This is not taught in the references, and there is no support of record for rejection.

Claim 93 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 93 defines a particular combination of first and second fiber types for the nanofibers and coarse fibers, namely a first group consisting of nylon, polyaramid, and cellulose, and a second group consisting of acrylic, polyester, polypropylene, and polymeric halocarbon. It is respectfully submitted that this combination is allowable.

Claim 94 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 94 requires that the nanofibers have different adsorption properties than the coarse fibers. In the Office Action, page 5, clause 21, the Examiner

notes that the applied reference is silent as to adsorptive properties of the fibers and nanofibers of the filter media, but that the claims are rejected as the prior art meets the chemical and physical limitations set forth in the parent claim upon which the rejected claim depends. In response, applicant respectfully but vigorously again invokes MPEP 2144.03, second paragraph, last sentence, and traverses such assertion.

Claim 95 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 95 requires that the nanofibers and coarse fibers have different surface charge characteristics providing a localized electric field gradient within the filter media enhancing particle removal from fluid to be filtered. In the Office Action, page 5, clause 21, the Examiner notes that the applied reference is silent as to surface charge, but that the claims are rejected as the prior art meets the chemical and physical limitations set forth in the independent claim upon which the rejected claims are dependent. In response, applicant respectfully but vigorously again invokes MPEP 2144.03, second paragraph, last sentence, and respectfully traverses such assertion.

Claim 96 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 96 requires that the nanofibers and coarse fibers have different wettability. In the Office Action, page 5, clause 21, the Examiner notes that the applied reference is silent as to wettability properties of the fibers and nanofibers of the filter media, however the claims are rejected as the prior art meets the chemical and physical limitations set forth in the independent claim upon which the rejected claims are dependent. In response, applicant respectfully but vigorously again invokes MPEP 2144.03, second paragraph, last sentence, and respectfully traverses such assertion.

Claim 97 depends from claim 96 and is believed allowable for the reasons noted above. Furthermore, claim 97 requires that the filter media captures droplets from a liquid to be filtered, and that the nanofibers are preferentially wetted by the droplets, and the coarse fibers are preferentially non-wetted by the droplets, whereby to create a capillary pressure gradient wicking droplets off the coarse fibers, facilitating drainage. This is

nowhere taught in the references. Consideration and allowance of claim 97 is earnestly solicited.

Claim 98 depends from claim 96 and is believed allowable for the reasons noted above. Furthermore, claim 98 requires that the filter media captures and coalesces droplets from a liquid to be filtered, and that the nanofibers are preferentially non-wetted by the droplets, and the coarse fibers are preferentially wetted by the droplets, whereby to create a capillary pressure gradient wicking droplets off the nanofibers, facilitating coalescence and drainage. This is nowhere taught in the references. Consideration and allowance of claim 98 is earnestly solicited.

Claim 99 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 99 requires a trimodal distribution of fiber diameter including a first set of fibers in the diameter range 50 to 500 nm, a second set of fibers in the diameter range 1 to 5 μm, and a third set of fibers in the diameter range 10 to 50 μm. In the Office Action, page 10, clause 45, the noted rejection of the defined trimodal distribution is based on Kahlbaugh et al. '321. However, the combination defined in claim 99, including its parent claim limitations, require the defined trimodal distribution within a single layer, in contrast to and distinctive over Kahlbaugh et al. '321. Consideration and allowance of claim 99 is earnestly solicited.

Claim 100 depends from claim 99 and is believed allowable for the reasons noted above. Furthermore, claim 100 requires that the first set of fibers be supported by the second set of fibers, and that the second set of fibers be supported by the third set of fibers, and that the first set of fibers provide the nanofibers, and the second and third sets of fibers provide the coarse fibers. This combination is nowhere taught nor suggested in the references. Consideration and allowance of claim 100 is earnestly solicited.

Claim 101 depends from claim 100 and is believed allowable for the reasons noted above. Furthermore, claim 101 requires that the defined second set of fibers comprise a fibrillated para-aramid polymer, and the third set of fibers comprise a cellulose matrix. This combination is believed allowable.

Claim 102 depends from claim 79 and is believed allowable for the reasons noted above. Furthermore, claim 102 defines a particular combination including the specifically defined constituency. This combination is believed allowable.

It is believed that this application is in condition for allowance with claims 79-102, and such action is earnestly solicited.

Respectfully submitted,

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